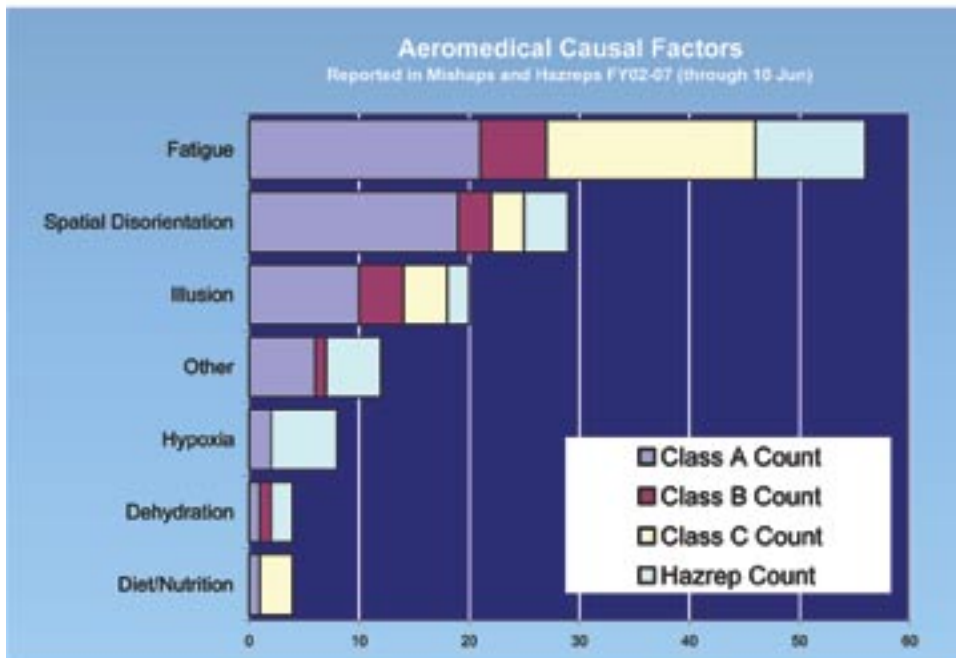


# Assessing How Fatigue Causes Mishaps

By Capt. Nick Davenport, MC and Capt. John Lee, MC

**F**atigue resulting from sleep deprivation, disrupted circadian rhythm, and/or associated conditions is the most frequently cited aeromedical causal factor in naval-aviation mishaps. Fatigue is four times more likely to contribute to workplace impairment than drugs or alcohol.



The term “fatigue” describes the constellation of signs and symptoms that result from sleep deprivation and circadian desynchrony. These problems lead to impaired performance and increased susceptibility to such conditions as spatial disorientation, visual illusions, and a variety of conditions that can increase mishap potential. Flight surgeons must look for fatigue as a root causal factor in all naval-aviation mishaps.

Identifying fatigue is difficult, because there are no simple measures. Drugs, alcohol, carbon monoxide, cyanide, and other toxins can be identified from post-mortem tissue and body-fluid

We now have a software tool that can assist in investigating and monitoring fatigue; it’s called the Fatigue Avoidance Scheduling Tool (FAST).

Almost all adults require 8 to 8.25 hours of quality sleep per night at the nightly circadian trough to retain full alertness and cognitive effectiveness. However, in many military operations and training, members get less than optimal sleep; therefore, performance and vigilance suffer. Also, travel across multiple time zones causes shifts of circadian rhythms, which can take from just a few days to more than two weeks for full recovery.

testing; however, no similar lab measurement identifies fatigue levels in a deceased aircrew member. Measuring vigilance and cognitive performance in a survivor immediately after a mishap isn’t possible or practical. And an aircrew’s self-assessment of fatigue has been shown to be poor: The greater the level of fatigue, the poorer the awareness of degraded performance.

Fatigue can be predicted if good information is available on a crew member’s sleep habits, timing and quality of sleep, and duty periods before the mishap. Computer modeling of fatigue physiology and prediction of expected aircrew performance at the time of the mishap is feasible.



## Who is at risk?

### People who:

- Don't allow enough time for sleep or don't get any sleep.
- Work at night.
- Travel across time zones.
- Have certain medical conditions, such as sleep apnea.
- Are exposed to anything that causes insomnia or poor quality sleep, such as repeated awakening from noise.

**We all are!**

FAST is one such computer program. It accepts information on date and location coordinates, an individual's sleep habits, duty times, sleep time, and sleep quality before a mishap. FAST will project expected cognitive performance, based on these variables. It also will accept the times and locations of all transmeridian travel (waypoints) and will calculate the effects of circadian shifts. FAST has been validated against a variety of test subject data from sleep-deprivation studies and has been shown to have up to 95-to-98-percent predictive ability in certain data sets.

The Naval Safety Center requires flight surgeons to analyze all 72-hour histories obtained in mishap investigations, using the FAST analysis software. In any mishap where aircrew traveled over multiple time zones in the two weeks before a mishap, a full 14-day history

is required and should be analyzed in FAST. A 14-day history also should be considered if there are any other factors where circadian shifting would be expected, such as in rotating shift work.

The following fatigue-related information should be collected by the aviation mishap board on all aircrew involved in a mishap:

1. Usual habits of the member regarding sleep. For example, what are the normal times the member goes to sleep and wakes up, both on weekday (or duty-day) and weekend (or off-day) nights? This information helps establish the times of normal circadian variation of each individual and allows some estimation of existing sleep debt.

2. The member's usual sleep quality. For example, how well does he or she usually sleep: excellent, good,

**Mishap-Free  
Milestones**

VAQ-130

26 years

42,987.6 hours

Most people sleep in the dark and are awake in daylight. When that cycle is interrupted by work schedules or the need to travel, the results are fatigue and impaired performance. Our brain requires sleep to recharge and reorganize. You cannot overcome lack of sleep or train to defeat sleep deprivation. It is not a matter of lack of motivation or training. If you don't make up for lost sleep, one way or another, the loss will take its toll.

fair, poor? (Excellent would be considered restful sleep with no nightly awakenings; fair includes up to two arousals per hour; poor is six or more arousals or awakenings per hour).

3. Any evidence for sleep pathology, such as sleep apnea, restless-leg syndrome, narcolepsy, or other medical conditions that may interfere with good quality sleep.

4. Sleep and wake times in the three days before a mishap and estimates as to the quality of each of these sleep periods. This documentation requires a detailed 72-hour history, including a record of times and quality of any nap periods during the day or night.

5. Use of any sleep or performance aids and when. For example, how many caffeinated beverages, sleeping pills, or performance-maintenance drugs were taken?

6. Times and location coordinates in latitude and longitude when beginning and ending any travel over time zones.

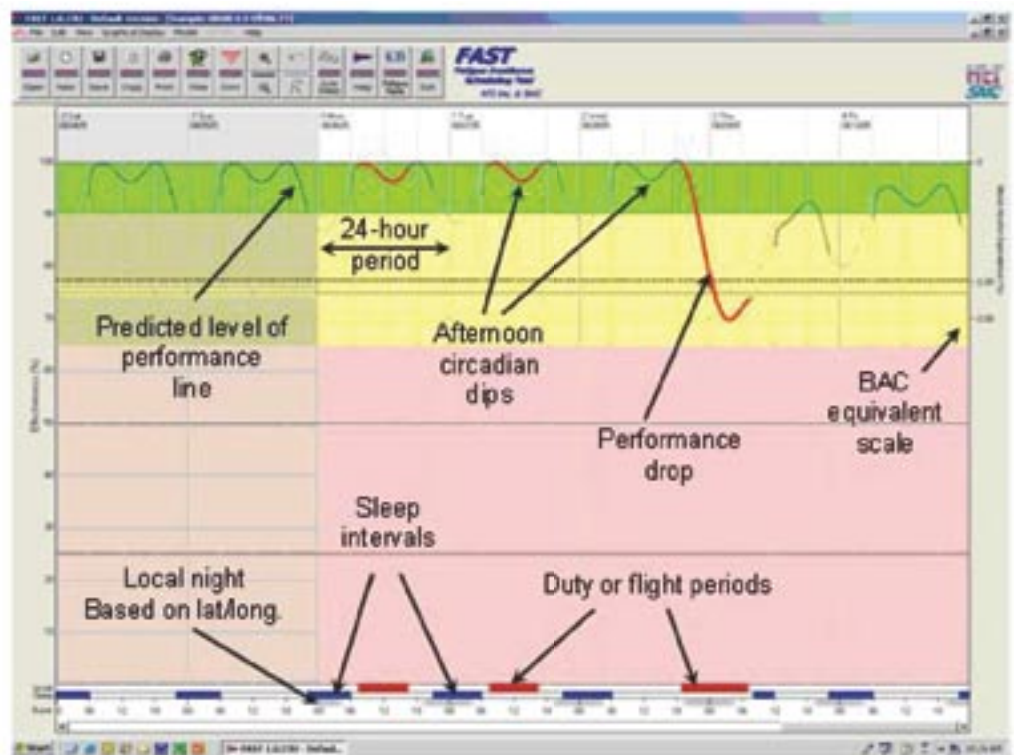
7. Time and location of the mishap.

The FAST program will accept all the above information (except medication effects) and produce plots of expected levels of cognitive performance, including a numerical assessment of the predicted effectiveness of the mishap member and propensity for lapses or microsleeps at the time of the mishap. Include the FAST plots as enclosures to the aeromedical analysis, and comment as to the likely accuracy or limitations in the data. Recognize that any FAST plots and results, if they are based on


72-hour or 14-day histories, can be obtained from privileged information and also are privileged.

Clearly, the validity of the prediction depends heavily on the accuracy and completeness of the input information, so the best possible attempt should be made to verify times and conditions of sleep in the 72- and 14-day histories. This data collection can be difficult, especially with deceased aircrew members. Try to validate times as much as possible from witness statements, family members, phone records, email transcripts, and any other sources which may help reconstruct the sleep and wake data.

Information on the FAST program can be downloaded from the Nova Scientific Corporation website at: [www.NovaSci.com](http://www.NovaSci.com); just click on the FAST icon. The program must be installed in a legacy computer because it has not gone through NMCI certification. Instructions come with the download on unzipping and installing the



*An example of a FAST plot is shown above.*

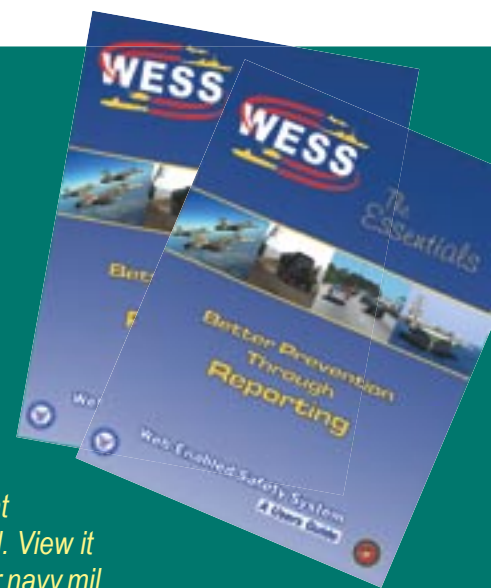
program on a computer on which you have administrative privileges, and on obtaining an activating license. The program is licensed to official DoD users only. Technical assistance in using the FAST program can be obtained by contacting the Aeromedical Division of the Naval Safety Center, (757) 444-3520, ext. 7228 or 7268, or the Command Flight Surgeon at the Naval School of Aviation Safety, at (850) 452-5140. Additional aeromedical information is available on the Naval Safety Center's website at [www.safetycenter.navy.mil/aviation/aeromedical](http://www.safetycenter.navy.mil/aviation/aeromedical). 

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## How do we deal with fatigue?

- ☐ **Recognize we are all at risk, and make sure you get enough sleep, at least six hours (but preferably eight hours) per night.**
- ☐ **Maintain a consistent bedtime and wake-up schedule, even on weekends.**
- ☐ **Exercise on a regular basis, but not within three hours of bedtime.**
- ☐ **Avoid caffeine products within four hours of going to sleep.**
- ☐ **Avoid alcohol within three hours of bedtime.**
- ☐ **Avoid tobacco products within one hour of bedtime.**

*A special issue  
WESS users guide  
is now available  
in your squadron.  
For additional  
copies contact:  
April Phillips,  
Naval Safety Center at  
[april.phillips@navy.mil](mailto:april.phillips@navy.mil). View it  
online at: [safetycenter.navy.mil](http://safetycenter.navy.mil)*



## WESS Update

### Training

The Naval Safety Center offers WESS training at your unit that is tailored to your specific needs. The training can range from a one-hour lecture to multiday, hands-on system operation, and includes the latest functions, changes, and improvements to WESS.

Online WESS tutorials can be found at:  
<http://www.safetycenter.navy.mil/wess/tutorial/aviation/>

### New Items

- **WESS search function**—This brief will show you how to use the JReport function to find a HAZREP, even if you do not have the date of the event.  
[http://www.safetycenter.navy.mil/wess/tutorial/aviation/WESS\\_Search\\_Info.ppt](http://www.safetycenter.navy.mil/wess/tutorial/aviation/WESS_Search_Info.ppt)
- **Safety authority procedures**—Required for all units in order to receive WESS accounts.  
<http://www.safetycenter.navy.mil/wess/tutorial/aviation/Pt8QuesSafetyAuth.ppt>

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